

Evaluation of rose hip species for processing of jam, jelly and soup

Vurdering af arter af hybenrose til fremstilling af syltetøj, gelé og suppe

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Summary

Experiments were carried out with the aim of determination of the suitability of fruits of rose hips for processing of jelly, jam, and soup. The evaluation was carried out by chemical analyses of the flesh and by organoleptical evaluation of soup, jam and jelly manufactured from the flesh.

After harvest in 1986-90 the fruits were frozen and kept at -25°C up to analyses and processing.

The species were rather different with respect to content of fruit flesh (47 to 74%), soluble solids (14 to 27%), total dry matter (19 to 38%) and fruit weight (1.4-8.0 g/fruit). Large differences in the content of vitamin C (410-2310 mg/100 g) among

species were found.

The species *R. canina* is very suitable for processing of soup. Other species which are suitable for manufacture of this product are *Rosa* × *collina* 'Andersonii', *R. moyesii*-hybrid 'Arthur Hillier', *R. rugosa*-hybrid 'Dagmar Hastrup', *R. × alba* 'Suaveolens' and *R. rubiginosa* 'Magnifica'.

Fruits from five species were found to be suitable for processing of jelly: *R. × collina* 'Andersonii', *R. × francofurtana* 'Francfort', *R. × borboniana* 'Louise Odier', *R. pendulina* 'Pillnitzer Vitaminrose', *R. rugosa* and *R. sweginzowii*.

Only *R. rugosa* including the variety 'Dagmar Hastrup' were suitable for jam making.

Key words: Rose hips, species, fruit size, vitamin C, dry matter, soluble solids, jam, jellies, soup.

Resumé

Der blev udført undersøgelser med det formål at bestemme anvendeligheden af frugter fra 24 arter af hybenroser til fremstilling af syltetøj, gelé og hybensuppe.

Efter høst i 1986 til 1990 er frugterne blevet dybfrosset, og der er blevet bestemt procent frugtkød samt indhold af totaltørstof, opløseligt tørstof og vitamin C.

Af frugtkødet er der blevet fremstillet syltetøj, gelé og suppe, der er blevet bedømt for organoleptisk kvalitet.

Der blev fundet betydelige artsforskelle på frugtvægt (1,4-8,0 g/frugt), indhold af frugtkød (47-74 pct.), indhold af opløseligt tørstof og totaltørstof på henholdsvis 14-27 og 19-38 pct. Indholdet af vitamin C varierede fra 410 til 2310 mg/100 gram frisk vægt.

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Arten *R. canina* er meget velegnet til fremstilling af hybensuppe. Andre arter som *R. × collina* 'Andersonii', *R. moyesii*-hybrid 'Arthur Hillier', *R. rugosa*-hybrid 'Dagmar Hastrup', *R. × alba* 'Suaveolens' og *R. rubiginosa* 'Magnifica' er sandsynligvis også velegnede.

Fem arter blev fundet velegnede til fremstilling

af gelé: *R. × collina* 'Andersonii', *R. francofurtana* 'Francfort', *R. × borboniana* 'Louise Odier', *R. pendulina* 'Pillnitzer Vitaminrose', *R. rugosa*, og *R. sweginzowii*.

Kun *R. rugosa* og *R. rugosa*-hybrid 'Dagmar Hastrup' blev fundet egnet til fremstilling af syltetøj.

Nøgleord: Hybenrose, arter, frugtstørrelse, vitamin C, totaltørstof, opløseligt tørstof, syltetøj, gelé, suppe.

Introduction

In Denmark many rose hip species grow along the roadsides, at the beaches, in hedgerows and at the edge of woods. Hips for processing are picked solely from wild growing plants.

Today, the Danish consumption of rose hips is limited, but if a rational growing method including mechanical harvest was available and new or better products could be developed consumer demands would eventually bring about substantial changes.

R. rugosa is the favourite species for jam making. However, this species is perpetual flowering and therefore ripening is very uneven, and it is difficult to estimate one optimum time of harvest. Many of the other rose hip species seem more promising to cultivate because of even ripening. However the knowledge of their suitability for processing is limited.

The aim of this study is to obtain an evaluation of rose hip species for processing of jam, jelly and soup.

Materials and methods

Species and harvesting

A rosarium consisting of about 145 species was established in 1979 for evaluation of ornamental value. In this plantation 24 species with good visually attributes: big fruits, many fruits, healthy plants and hips without attack of diseases, were chosen for the first evaluation in 1986. Table 1 reviews all examined species in 1986-90.

The hips were picked after development of red skin, but before severe softening of the fruits.

Analyses

Fruit size was determined by weighing 25 (1986 and 1987) or 100 (1989 and 1990) hips per species.

The hips were then deep frozen and stored at -25°C . After storage for 3-6 months per cent fruit flesh was determined and analyses were carried out. Finally soup, jelly and jam were processed.

In 1986-89 the amount of fruit flesh was determined after removal of the seeds by hand, while in 1990 the frozen rose hips was crushed with a hammer and the seeds were removed by use of a sieve with 6 mm circular holes.

Raw frozen rose hips were analyzed for content of vitamin C, soluble solids and total dry matter. The content of vitamin C in the rose hips was determined by use of the method described by *Pongracz* (7). The content of soluble solids was determined by refractometry by use of a Bausch & Lomb refractometer and the content of total dry matter was determined by drying of samples at 80°C for 24 hours.

Soup

In 1986 soup was processed according to the recipe given by *Christensen* and *Falk Kühn* (3). Equal amounts of rose hips and water were boiled for 45 minutes, and the rose hips were pressed through a sieve to obtain fruit sauce. After addition of 10% sugar, filling, pasteurization, and cooling the products were stored at 5°C .

Jam

For processing of jam, the frozen fruit flesh and water were heated to boiling point. At this stage in 1987-89 the fruit flesh was blended by use of a Waring blender, while in 1990 the heated mixture of water and fruits was kept for 30 minutes without cooling. The fruit flesh content in the jam was 35%, but the content of sugar was 40 and 27% in 1987-1989 and 1990 respectively. This means that the content of water was 24.4 and 37.4. Pectin

Table 1. Species of rose hip in experiments 1986-90.
Hybenroser i forsøg 1986-90.

Species Art	1986	1987	Year År 1988	1989	1990
<i>R. × alba</i> 'Suaveolens'	x*	x	x		x
<i>R. borboniana</i> 'Louise Odier'	x		x	x	x
<i>R. canina</i> clone 1	x	x	x		
<i>R. canina</i> clone 2	x	x	x	x	x
<i>R. carolina</i> clone 1	x				
<i>R. carolina</i> clone 2	x				
<i>R. × collina</i> 'Andersonii'	x		x	x	x
<i>R. davidii</i>	x				
<i>R. dumalis</i> clone 1					x
<i>R. dumalis</i> clone 2	x	x	x		
<i>R. × francofurtana</i> 'Francfort'	x		x	x	x
<i>R. glauca</i>	x	x	x		
<i>R. × highdownensis</i>	x	x	x	x	x
<i>R. moyesii</i> 'Eddie's Jewel'	x		x		
<i>R. moyesii</i> -hybrid 'Arthur Hillier'	x			x	x
<i>R. nitida</i>	x				
<i>R. pendulina</i>		x			
<i>R. pendulina</i> 'Pillnitzer Vitaminrose'		x	x	x	x
<i>R. pimpinellifolia</i>	x	x			
<i>R. rubiginosa</i>	x	x			
<i>R. rubiginosa</i> 'Magnifica'	x		x	x	x
<i>R. rugosa</i>	x	x	x	x	x
<i>R. rugosa</i> -hybrid 'Dagmar Hastrup'	x	x	x	x	x
<i>R. sherardii</i>		x	x	x	
<i>R. sweginzowii</i>	x	x	x	x	x
<i>R. villosa</i>	x		x	x	x
<i>R. virginiana</i>	x		x		
<i>R. virginiana</i> var. <i>nigricans</i>	x		x		

* x = sampling, analyses and processing.

x = prøveudtagning, analyser og forarbejdning.

(0.4% LM-101 AS) mixed with one third of the sugar was added after repeated heating to boiling point. After the third heating to boiling point the remaining sugar was added and pH was adjusted to 3.0 with 50% citric acid solution. Finally solutions of sodium benzoate (0.1%) and potassium sorbate (0.1%) were added. The jam was poured into glass jars, which were cooled in running tap water and then kept at 4°C up to sensory evaluation within 14 days.

Jelly

In 1988 jelly was processed from the 19 species and cultivars mentioned in Table 1 but not including: *R. canina* clone 1, *R. dumalis* clone 2, *R. virginiana* and *R. virginiana* var. *nigricans*.

Two hundred gram of fruit flesh and 100 g water were heated to boiling point and then treated in a Waring blender. After cooling to 40°C a solution of pectin degrading enzymes (Pektolase LA, Grindsted Products) was added, and the sample was kept for one hour at a constant temperature. Juice was processed by pressing of the mash in a Tincture Press with increasing pressure up to 200 kg/cm² within one hour.

Jelly with 28% fruit was processed by heating the juice to boiling point, addition of 0.6% Genu Pectin (type A, medium set, Københavns Pektin-fabrik) mixing with one third of the sugar, adjustment of pH to 3.0 with 50% citric acid solution, repeated heating and addition of sugar up to 56.4%. Finally sodium benzoate (0.1%) and

potassium sorbate (0.1%) were added before filling of glass jars and cooling in running tap water to 15°C. The products were stored at 4°C up to organoleptical evaluation within 14 days.

Organoleptical evaluation

The organoleptical quality was evaluated by an expert panel of four panellists, who were familiar with the products.

Statistical analyses

Statistical analyses were carried out by use of linear regression analysis and analysis of variance with multiple range test.

Results

As shown in Fig. 1a the weight of hips ranged from 1.4 g in *R. × collina* 'Andersonii' to 8.0 g in *R. rugosa*-hybrid 'Dagmar Hastrup'.

Fig. 1b shows that the percentage fruit flesh ranged from 47 in *R. rugosa* to 74 in *R. moyesii*-hybrid 'Arthur Hillier'. The correlation coefficient between fruit size and hip flesh is poor (0.17) indicating no relationship between these two attributes.

As shown in Fig. 1c the content of dry matter in the hip flesh ranged from 19% in *R. rugosa*-hybrid 'Dagmar Hastrup' to 38% in *R. × collina* 'Andersonii'.

The relationship between the content of total dry matter and soluble solids was tested by use of linear regression analyses by which a correlation coefficient of 0.94 was found. The content of soluble solids in hip flesh was from 14% in *R. rugosa*-hybrid 'Dagmar Hastrup' to 27% in *R. borboniana* 'Louise Odier'.

According to Fig. 1d the content of vitamin C ranged from 400-1500 mg/100 g.

R. canina is very suitable for processing of soup because a product with a very good flavour can be manufactured. Other species having medium to good flavour which are also suitable for manufacturing of this product are: *R. × collina* 'Andersonii', *R. moyesii*-hybrid 'Arthur Hillier', *R. rugosa*-hybrid 'Dagmar Hastrup', *R. × alba* 'Suaveolens' and *R. rubiginosa* 'Magnifica'.

Jelly processed from the following species was found to have a medium to strong flavour: *R. × collina* 'Andersonii' (yellow colour) *R. × francofurtana* 'Francfort' (sour), *R. × borboniana* 'Louise Odier' (bad colour) *R. pendulina*

'Pillnitzer Vitaminrose' (nice orange colour), *R. rugosa* and *R. sweginzowii*.

A delicious jam, with a strong flavour was obtained using hips of *R. rugosa* and *R. rugosa*-hybrid 'Dagmar Hastrup'. From the following species jam with good flavour but tough skin could be processed: *R. moyesii*-hybrid 'Arthur Hillier' (nice colour) *R. francofurtana* 'Francfort' (gritty consistency) *R. pendulina* 'Pillnitzer Vitaminrose', *R. sweginzowii* (sour) and *R. villosa*.

Discussion

Harvesting

When new rose hip products are to be developed, it is obvious to select good tasting species from the high level vitamin C group. A great annual variation of the organoleptical evaluations indicate that determination of the optimum harvest time is very important for obtaining high quality of the products. It has been demonstrated that both the water content and the vitamin C content will decrease in overripe rose hips (4, 9). It is likely that the flavour is also strongly influenced by the harvest time.

Fruit weight

R. rugosa-hybrid 'Dagmar Hastrup' is separated from the other species by having the biggest fruits. This species had the largest processable fruit part (fruit weight × percentage fruit flesh) as well, 5.6 g per hip. But in general no correlation was found between fruit size and percentage fruit flesh.

Fruit flesh

For one of the big sized species *R. rugosa* less than half of the fruit was processable and for *R. canina* a small fruited species a little more than half of the fruit was fruit flesh. Pyke and Melville (8) found for 14 species a range from 58 to 76 per cent fruit flesh and in 1946-47 (5) they found that the same 14 species ranged from 58 to 65 per cent fruit flesh. The very low value of per cent fruit flesh in *R. rugosa* was due to an inexplicable low value in one year. Incorrect harvest time is probably not the reason, since the vitamin C content, which depend on the stage of ripening (4, 11) did not differ much from the other years.

Vitamin C

The observed vitamin C levels are on the whole in

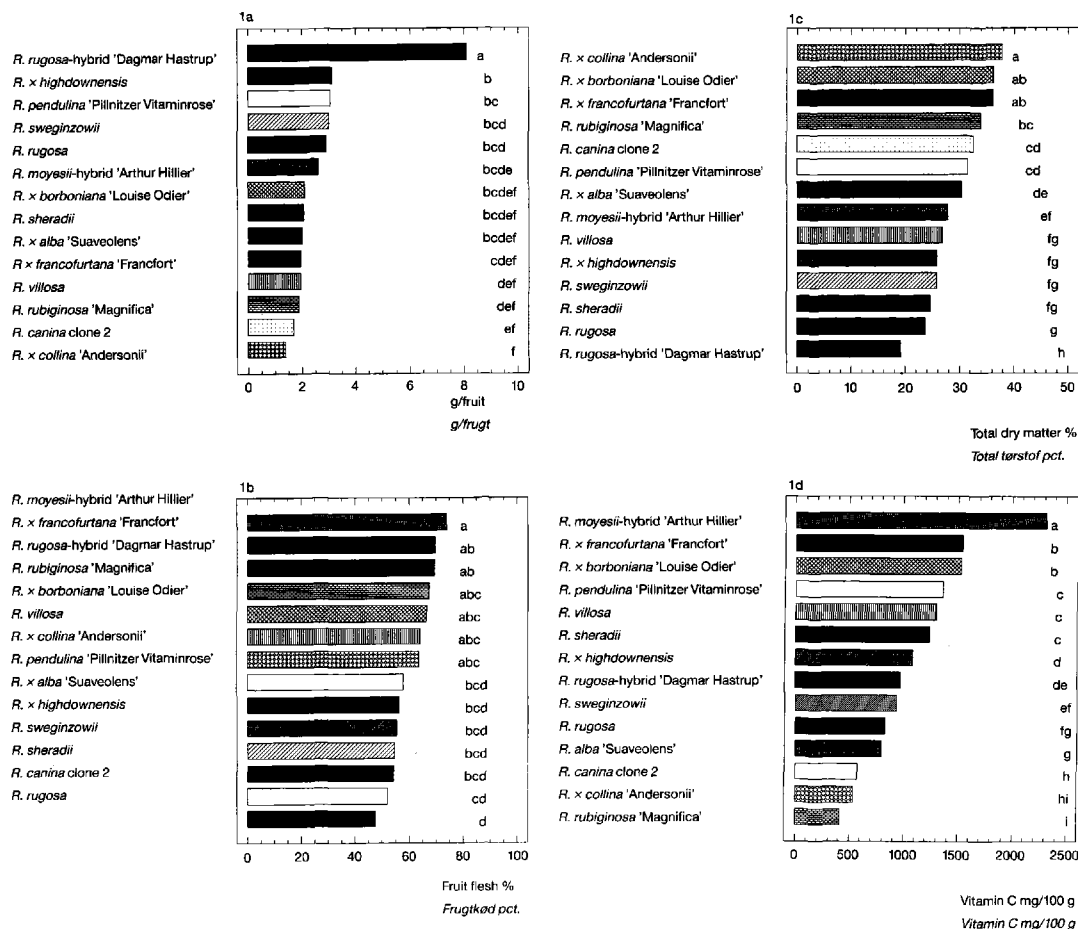


Fig. 1. a. Fruit size (average 1986-90), b. percentage fruit flesh (average 1986-90), c. total dry matter (average 1988-90) and d. content of vitamin C in the fruit flesh (average 1987-90).
a. Frugt vægt (gns. 1986-90), b. procent frugtkød (gns. 1986-90), c. total tørstof (gns. 1988-90) og d. indhold af vitamin C i frugtkødet (gns. 1987-90).

quite good agreement with published values (5, 8, 11). It was found that species of rose hips contained from 410 to 2310 mg vitamin C per 100 g fruit flesh (Table 1d), while citrus fruits contain about 60 mg per 100 g (10).

Soup

Evaluation of the species for processing of the soup was carried out by use of the results published by Christensen and Falk Kühn (3). The species *R. canina* is very suitable for processing of soup. Other species which are suitable for the manufacture of this product are *R. × collina* 'An-

dersonii', *R. moyesii*-hybrid 'Arthur Hillier', *R. rugosa*-hybrid 'Dagmar Hastrup', *R. × alba* 'Suaveolens' and *R. rubiginosa* 'Magnifica'. In Sweden the most promising species for soup production are considered to be: *R. canina*, *R. dumalis*, *R. rubiginosa* and *R. pendulina*. *R. pimpinellifolia* are interesting because of a high content of anthocyanins (11).

Jam

R. rugosa, the best suited species for processing of jam, has compared to other species of rose hip, a rather low content of vitamin C, but the content is

still 15 times that of citrus fruit. Species with medium to good hip flavour were found within each vitamin C group.

Jelly

Fruits from five species were found to be suitable for processing of jelly: *R. × collina* 'Andersonii', *R. × francofurtana* 'Francfort', *R. × borboniana* 'Louise Odier', *R. pendulina* 'Pillnitzer Vitaminrose', *R. rugosa* and *R. sweginzowii*.

Processing

As described above rose hips are useful for processing of jam, jelly and soup but the fruits can also be used for processing of tea, baby food, nectar, wine and spirits (1, 4, 9, 12).

With respect to optimization of the industrial processing it is necessary to optimize removal of seeds and the stabbing hairs before further processing of the fruit flesh. Further work is being carried out with the aim of the development of equipment for these purposes.

Today, when processing of soup the seeds are removed by pulping of the boiled or blanched fruits but a more sophisticated method including removal of the hairs can be developed.

Rosa sections

The genus *Rosa* is botanically divided into ten sections. It has been claimed that the special hip flavour is found mostly in species belonging to one of the sections: *Canina* (2, 6). However, this work has shown that good hip flavour can be found in two of the sections in the genus *Rosa*. These are the section *Canina* with the species *R. rubiginosa*, *R. villosa*, and *R. canina* and the section *Cinnamomeae* with the species *R. moyesii*, *R. pendulina*, *R. rugosa*, *R. sweginzowii* and *R. × highdowniensis*.

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